IMPACT OF MOTOR VEHICLES-BICYCLES INTERACTION ON ROUTE SELECTION, TRAFFIC PERFORMANCE, EMISSIONS AND SAFETY: A LOOK TO DRIVING VOLATILITY

Behnam Bahmankhah
Centre for Mechanical Technology and Automation (TEMA)
Department of Mechanical Engineering
University of Aveiro, Portugal
behnam.bahmankhah@ua.pt

Margarida C. Coelho
Centre for Mechanical Technology and Automation (TEMA)
Department of Mechanical Engineering
University of Aveiro, Portugal
margarida.coelho@ua.pt

Doctoral thesis

Unexpected driving volatility of motor vehicles (MV) can lead to safety concerns and subsequently more emissions. Regarding the presence of bicycles at urban areas these concerns may increase mainly at narrow traffic lanes.

This PhD thesis was focused on two main sections which is developed based on the previous presented work at GET2017, 2018; (*i*) the main characteristics/impacts of MV-bicycle interaction for a proper route selection (*ii*) the main characteristics/impacts of MV-bicycle volatility on safety, emissions and traffic performance at two different two-lane roundabouts. The main objective of this new section is focused on the impacts of the MV-bicycle interactions on safety and energy consumptions at two-lane roads. The overtaking lateral distance variation between a bicycle and a motor vehicle (MV) and its relationship with traffic volumes were analyzed along an urban traffic corridor in Aveiro, Portugal.

The methodology was developed based on human required power to ride a bicycle that is called Bicycle Specific Power (BSP) and Vehicle Specific Power (VSP) for MVs in order to analyze the impacts on human/vehicle energy consumption while the cyclist and driver behaviors were considered to analyze the driving volatility.

Second-by-second bicycle and vehicle dynamic data were collected using GPS travel recorders. An on-board sensor platform was installed on a bicycle besides the movable camera to record the other drivers' behaviors as well. After that, VSP and BSP methods used to compute modes distribution during the peak hours and then several correlations between overtaking lateral distance and above variables.

The results showed 50% of overtaking lateral distance lower than 0.5m in both morning and afternoon peak hours. Regarding driving behavior, most of the critical points of acceleration/deceleration profiles were observed at the instant the traffic light turns green or when there was a stop-and-go situation. The analysis of BSP and VSP for different values of overtaking lateral distance did not result in any relationship between variables. In contrast, there was a good fit between traffic volumes variation and overtaking distance variation in the morning ($R2 = 0.72$) and afternoon ($R2 = 0.67$) peak hours.

KEYWORDS: Driving volatility, Overtaking distance, Bicycle, BSP, VSP, Energy Consumption, Safety
PERIOD: 1st of January 2015 – 31st of March 2019
ACKNOWLEDGEMENTS: FCT Project @CRUiSE, funded under Project 9471 - Strengthening Research, Technological Development and Innovation (Project 9471 - RIDTI) and supported by the European Community Fund ERDF, and to the Strategic Project UID-EMS-00481-2013 and MobiWise (P2020 SAICTPAC/0011/2015, co-funded by COMPETE2020, Portugal2020 - Operational Programme for Competitiveness and Internationalization, European Union ERDF and FCT)